UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 21 1994

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

Subject: PP#9F3787. Abamectin (Avermectin B_1) for Use in/on Pears. Anticipated Residues of Abamectin in/on Crops With Established Tolerances (Celery, Citrus, Cotton, Lettuce, Strawberries, and Tomatoes) and Pending Tolerances Which Have Only Minor CBTS/CBRS Data Deficiencies (Almonds, Pears, and Walnuts) to be Used in Both **Acute and Chronic Dietary Risk Assessments.**

(DP Barcode# D207554, CBTS# 14388)

From: G. Jeffrey Herndon, Chemist
Tolerance Petition Section II
Chemistry Branch I - Tolerance Support
Health Effects Division (7509C)

G. Jeffrey Herndon

Through: Richard A. Loranger, Ph.D., Acting Chief
Chemistry Branch I - Tolerance Support
Health Effects Division (7509C)

R. Loranger

To: George LaRocca/Adam Heyward, PM# 13
Insecticide-Rodenticide Branch
Registration Division (7505C)

and

Albin Kocialski, Head
Registration Section
Chemical Coordination Branch
Health Effects Division (7509C)

In conjunction with PP#9F3787 (Section 3 and permanent tolerance request for use of avermectin on pears), Merck has requested that the Agency perform both acute and chronic anticipated residue estimates from the use of avermectin. CBTS has been requested to calculate residue values to be used in the dietary exposure assessment.

Conclusions and Recommendations

CBTS recommends that the residue values in Table 1 be used in the acute and chronic dietary risk assessment for avermectin.

Table 1

Acute and Chronic Residue Values to be Used in the Dietary Risk Assessment of Avermectin

DRES entry	Entry for ACUTE Risk Assessment (ppm)	Entry for CHRONIC Risk Assessment (ppm)
almonds	0.005	0.00125
beef fat	0.014	0.006
beef lean	0.002	0.002
beef kidney	0.005	0.002
beef liver	0.020	0.008
beef dried	0.002	0.002
beef meat byproducts	0.020	0.008
celery	0.035	0.011
cottonseed meal	0.005	0.0005
cottonseed oil	0.00063	0.0002
grapefruit juice	0.017	0.00085
grapefruit pulp	0.01	0.0005
kumquats	0.02	0.004
lemon juice	0.005	0.00025
lemon peel	0.05	0.0025
lemon pulp	0.01	0.0005
lettuce, head varieties	0.05	0.009
lime juice	0.005	0.00025
lime peel	0.05	0.0025
lime pulp	0.01	0.0005
milk sugar	0.001	0.00025
milk fat	0.004	0.001
milk, non-fat solids	0.004	0.001
orange juice	0.005	0.001
orange peel	0.05	0.01
orange pulp	0.01	0.002
pears, dried	0.088	0.035
pears, fresh	0.02	0.008
strawberries	0.02	0.004
tangelos	0.02	0.001
tangerines	0.02	0.001
tangerine juice	0.005	0.00025
tomato catsup	0.011	0.0022
tomato juice	0.0021	0.00042
tomato paste	0.012	0.0024
tomato puree	0.004	0.0008
tomato, whole	0.01	0.002
walnuts	0.005	0.00125

Detailed Considerations

General

Residue values were generated for those commodities for which CBTS has, either, recommended that permanent tolerances be established, or only minor deficiencies stand in the way of CBTS recommending that permanent tolerances be established. No temporary tolerance or residue values from Section 18 requests were used.

No data concerning percent crop treated were used. Due to the relative large number of new or pending uses, CBTS did not feel that use of percent crop treated data was warranted at this time.

The risk assessment for almond and walnut commodities is based on the remaining deficiencies associated with PP#1F3973/1H5611 being satisfactorily resolved (see memo of G.J. Herndon dated 5/19/94). If the proposed rate (0.025 lb.ai./A./application), PHI (21 days), and/or tolerance (0.005 ppm on almonds and walnuts, 0.10 on almond hulls) need to be changed, a new risk assessment will need to be performed.

The risk assessment for pears is based on the proposed enforcement method passing Beltsville lab validation (see memo of G.J. Herndon dated 10/21/94). If the method does not pass and the proposed rate (0.025 lb.ai./A./application), PHI (28 days), and/or tolerance (0.02 ppm) need to be changed, a new risk assessment will need to be performed.

The current label has a restriction against feeding cotton gin byproducts (gin trash), so no residue data have been submitted to the Agency for this commodity. The new Table II (June 1994) no longer allows a feeding restriction for cotton gin byproducts. When Merck submits additional avermectin residue data from cotton gin byproducts to the Agency, a new risk assessment will need to be performed taking this cow feed item into account in beef and milk tolerances.

The cow diet constructed in Tables 15, 17, 18, and 20 may be realistic from a nutrient standpoint, but may not be realistic from a crop logistic standpoint. For instance, the citrus produced in California is predominately fresh market; almost the entire U.S. production of citrus pulp (the animal feed item) occurs in Florida and, domestically, is not typically transported long distances (fed in northern Florida and southern Georgia). Almost the entire U.S. production of almonds is grown in California, and due to their moisture content and low level of nutrients, almond hulls would not likely be fed to cattle outside California. Production of tomatoes for processing does not occur to any appreciable extent in Florida; dried tomato pomace is produced in California (as well as other states), but once dried, keeps well and is routinely transported long distances. Therefore, depending on the nature and magnitude of

the risk estimate that is achieved using the values in Table 1, additional assumptions on what a cow would realistically eat could be made for an updated or future risk assessment.

Handling of Non-Quantifiable (NQ) and Non-Detectable Residues in the Chronic Risk Assessment

All Crops **Except** Pears and Strawberries

The matrix and methodology allow for a limit of quantitation of 5 ppb and limit of detection of 2 ppb. In the following tables, the designations NQ and ND will be used. NQ refers to samples that were not quantifiable (2 - 5 ppb). Since these samples exhibited a clear peak in the retention time window of the compound of interest, albeit below the limit of quantitation (5 ppb), a value of 5 ppb will be assigned to these samples for the purposes of chronic risk assessment. ND refers to samples that were not detected (< 2 ppb). For the purposes of chronic risk assessment, a value of 1 ppb (½ X 2 ppb) will be used.

If B_1a is ND

Abamectin (avermectin B_1) is produced by a fermentation process using a strain of Streptomyces avermitilis. (This manufacturing process was reviewed in detail in L. Cheng's memo dated 5/1/86 reviewing EPA 618-OL). The technical product abamectin is a mixture of two homologs containing not less than 80% avermectin B_1a and not greater than 20% avermectin B_1b. These components differ by only one methylene unit at the 25-carbon position, wherein avermectin B_1a contains a sec-butyl group and avermectin B_1b contains an isopropyl group. Based on the residue data reviewed to date, the metabolism in plants does not seem to alter this ratio of B_1a to B_1b (at least 4 to 1). Therefore, for the purposes of chronic risk assessment, for those samples which exhibit non-detectable (ND) B_1a residues, a value of ¼ of ND will be used to estimate B_1b residue levels. Since a value of 1 ppb will be used for ND B_1a residues, a value of 0.25 ppb (¼ X 1 ppb) will be used to estimate the B_1b residue contribution of those samples.

Pears and Strawberries

Merck worked to improve the sensitivity of the analytical methodology for the analysis of avermectin residues in the pear and strawberry matrix; the limit of quantitation is 2 ppb and limit of detection is 1 ppb. In Tables 11 and 12, NQ refers to samples that were not quantifiable (1 - 2 ppb). Since these samples exhibited a clear peak in the retention time window of the compound of interest, albeit below the limit of quantitation (2 ppb), a value of 2 ppb will be assigned to these samples for the purposes of chronic risk assessment. ND refers to samples that were not

detected (< 1 ppb). For the purposes of chronic risk assessment, a value of 0.5 ppb (½ X 1 ppb) will be used.

If B_1a is ND

See section above (All Crops **Except** Pears and Strawberries, If B_1a is ND). Therefore, for the purposes of chronic risk assessment, for those samples which exhibit non-detectable (ND) B_1a residues, a value of ¼ of ND will be used to estimate B_1b residue levels. Since a value of 0.5 ppb will be used for ND B_1a residues, a value of 0.125 ppb (¼ X 0.5 ppb) will be used to estimate the B_1b residue contribution of those samples.

Commodities

Almonds

The proposed label rate is 0.025 lb.ai./A./application with a 21 day PHI.

Nuts

Acute

The pending tolerance (PP#1F3973) for residues of avermectin on almonds is 0.005 ppm. No additional processed commodities are associated with this RAC. **CBTS recommends that the tolerance value of 0.005 ppm be used as the acute anticipated residue for almonds.**

Chronic

Data on almond nutmeats were provided in conjunction with PP#1F3973 (see memo of G.J. Herndon dated 11/26/91). At 1X (0.025 lb.ai./A./application) and 2X rates and PHIs ranging from 0 to the 21 days proposed on the label, all samples (148 total samples analyzed) were ND for both B_1a to B_1b. Therefore, for chronic risk assessment purposes, we will use a B_1a concentration of 1 ppb and a B_1b concentration of 0.25 ppb, for a total of 1.25 ppb. **CBTS recommends that a value of 0.00125 ppm be used as the chronic anticipated residue for almonds.**

Hulls

Acute

The pending tolerance (PP#1F3973/1H5611) for residues of avermectin on almond hulls is 0.10 ppm. No additional processed commodities are associated with this RAC. An almond hull value of 0.10 ppm will be used in the livestock feed calculation for determining the acute anticipated residue for milk (see Milk entry

below).

Chronic

Data on almond hulls were provided in conjunction with PP#1F3973 (see memo of G.J. Herndon dated 11/26/91). Residue data representing the proposed rate and PHI (21 days) are shown in Table 2 below.

Table 2

Residue Summary of Avermectin in/on Almond Hulls

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-88-6028R	ND (1)	ND (0.25)	1.25
001-88-6032R	42.2	NQ (5)	47.5
001-88-6034R	70.0	6.7	76.7
001-88-6035R	53.4	5.9	59.3
001-89-6019R	15.6	ND (1)	16.6
001-89-6020R	28.3	NQ (5)	33.3

From the data above, a mean of 39.11 ppb was determined (6 entries for a total of 234.65 ppb). An almond hull value of 0.039 ppm will be used in the livestock feed calculation for determining the chronic anticipated residue for milk (see Milk entry below).

Celery

The labeled rate is 0.02 lb.ai/A./application with a 7 day PHI.

Acute

The established tolerance for residues of avermectin on celery is 0.035 ppm. No additional processed commodities are associated with this RAC. **CBTS recommends that the tolerance value of 0.035 ppm be used as the acute anticipated residue for celery.**

Chronic

Data on celery were provided in conjunction with PP#8F3649. Residue data representing the labeled rate and PHI are shown in Table 3 below.

Table 3

Residue Summary of Avermectin in/on Celery

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-86-024R	11.1	ND (1)	12.1
	18.1	NQ (5)	23.1
	7.2	ND (1)	8.2
	15.6	ND (1)	16.6
001-86-025R	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
001-86-026R	NQ (5)	ND (1)	6
	6.4	ND (1)	7.4
	6.4	ND (1)	7.4
	7.9	ND (1)	8.9
001-86-029R	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
001-86-146R	NQ (5)	ND (1)	6
	6.3	ND (1)	7.3
	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6
001-86-147R	8.8	ND (1)	9.8
	9.5	ND (1)	10.5
	14.7	ND (1)	15.7
	15.8	NQ (5)	20.8
001-86-557R	10.6	ND (1)	11.6
	6.6	ND (1)	7.6
	7.8	ND (1)	8.8
	8.2	ND (1)	9.2
001-86-558R	NQ (5)	ND (1)	6
	7.2	ND (1)	8.2
	5.6	ND (1)	6.6
	5.7	ND (1)	6.7
001-86-565R	35.6	NQ (5)	40.6
	8.7	ND (1)	9.7
	16.5	ND (1)	17.5
	14.0	ND (1)	15.0

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-86-671R	8.7	ND (1)	9.7
	8.5	ND (1)	9.5
	7.8	ND (1)	8.8
	7.9	ND (1)	8.9
001-87-0002R	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
001-87-0014R	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
	6.0	ND (1)	7.0
	10.1	ND (1)	11.1
001-87-1012R	29.1	NQ (5)	34.1
	7.3	ND (1)	8.3
	20.0	ND (1)	21.0
	7.2	ND (1)	8.2
	8.3	ND (1)	9.3
	8.2	ND (1)	9.2
	NQ (5)	ND (1)	6
	18.2	ND (1)	19.2
001-87-1013R	11.1	ND (1)	12.1
	18.8	ND (1)	19.8
	23.1	NQ (5)	28.1
	23.1	NQ (5)	28.1
	19.8	ND (1)	20.8
	24.2	NQ (5)	29.2
	19.5	ND (1)	20.5
	22.1	ND (1)	23.1
	9.5	ND (1)	10.5
	8.8	ND (1)	9.8
	12.2	ND (1)	13.2
	12.5	ND (1)	13.5
	5.6	ND (1)	6.6
	6.4	ND (1)	7.4
	11.0	ND (1)	12.0
	11.8	ND (1)	12.8

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-87-5028R	7.5	ND (1)	8.5
	7.3	ND (1)	8.3
	5.6	ND (1)	6.6
	22.4	ND (1)	23.4
	8.1	ND (1)	9.1
	5.7	ND (1)	6.7
	9.1	ND (1)	10.1
	9.6	ND (1)	10.6

From the data above, a mean of 11.23 ppb was determined (84 entries for a total of 943.65 ppb). **CBTS recommends that a value of 0.011 ppm be used as the chronic anticipated residue for celery.**

Citrus

The current label rate is 0.025 lb.ai./A./application with a 7 day PHI.

Acute

The established tolerances for residues of avermectin on citrus commodities are shown below:

citrus, whole fruit	0.02 ppm
citrus, pulp (dried)	0.10 ppm
citrus, oil	0.10 ppm

Based on the concentration factors discussed below (see Processing Data under Chronic), **the following residue values should be used for estimating the acute anticipated residues for the following processed citrus commodities.**

DRES entries

grapefruit	
juice	**0.85 X RAC = 0.017 ppm**
pulp	**0.5 X RAC = 0.01 ppm**
lemons	
juice	**0.25 X RAC = 0.005 ppm**
peel	**2.5 X RAC = 0.05 ppm**
pulp	**0.5 X RAC = 0.01 ppm**
limes	
juice	**0.25 X RAC = 0.005 ppm**
peel	**2.5 X RAC = 0.05 ppm**
pulp	**0.5 X RAC = 0.01 ppm**
kumquats	**RAC = 0.02 ppm**

orange	
juice	**0.25 X RAC = 0.005 ppm**
peel	**2.5 X RAC = 0.05 ppm**
pulp	**0.5 X RAC = 0.01 ppm**
tangelos	**RAC = 0.02 ppm**
tangerine	**RAC = 0.02 ppm**
tangerine juice	**0.25 X RAC = 0.005 ppm**

Chronic

In support of PP#8F3592 (see memo of M. Kovacs dated 4/25/88), the residue data, shown in Tables 4-7 below, were submitted:

RAC

Orange

Table 4

Residue Summary of Avermectin in/on Oranges

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-86-061R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-169R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-196R	8.1	ND (1)	9.1
	7.8	ND (1)	8.8
001-86-515R	NQ (5)	ND (1)	6
	NQ (5)	ND (1)	6
001-86-596R	10.1	ND (1)	11.1
	11.2	ND (1)	12.2
001-86-698R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-003R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25

From the data above, a mean of 4.11 ppb was determined (16 entries for a total of 65.7 ppb). **CBTS recommends that a value of 0.004 ppm be used as the chronic anticipated residue for whole oranges.**

Grapefruit

Table 5

Residue Summary of Avermectin in/on Grapefruit

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-86-002R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-620R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25

From the data above, a mean of 1.25 ppb was determined. **CBTS recommends that a value of 0.001 ppm be used as the chronic anticipated residue for whole grapefruit.**

Tangelo

Table 6

Residue Summary of Avermectin in/on Tangelos

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-86-001R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-062R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25

From the data above, a mean of 1.25 ppb was determined. **CBTS recommends that a value of 0.001 ppm be used as the chronic anticipated residue for whole tangelos.**

Lemon

Table 7

Residue Summary of Avermectin in/on Lemons

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-86-114R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25

From the data above, a mean of 1.25 ppb was determined. **CBTS recommends that a value of 0.001 ppm be used as the chronic anticipated residue for whole lemons.**

Other Field Residue Data

The residue data (oranges grapefruit, tangelos and lemons) presented in PP#5G3287/5H5474 (see memo of L. Cheng dated 12/19/85) will not be used for the chronic risk assessment due to a questionable quantitation limit (1.0 ppb) and insufficient validation data provided to substantiate this claimed limit of quantitation.

Processing Data

Data from a citrus processing study (submitted in conjunction with PP#8F3592) using an exaggerated rate (4X) and shorter PHI (3 days vs. 7) are shown in Tables 8 and 9.

Table 8

Results from a Citrus Processing Study Using a 4X Rate and 3 Day PHI

	Averaged Avermectin Residues (ppb)			
crop	whole fruit	washed fruit	dried pulp + peel	oil
orange (Hamlin)	9.9	< 5	44.1	54.1
tangelo	17.0	9.2	73.7	117.6
grapefruit	9.0	< 5	10.9	87.3

Table 9

Citrus Concentration Factors Based on the Residue Data from Table 8

	commodity		
crop	washed fruit	dried pulp + peel	oil
orange (Hamlin)	< 0.5X	4.5	5.5
tangelo	0.5X	4.3	6.9
grapefruit	< 0.55X	1.2	9.7

Other Processing Data

Additional processing data were provided in PP#5G3287/5H5474 (see memo of L. Cheng dated 12/19/85). However, these data were of limited value for determining concentration factors due to unmeasurable residues on many of the commodities (as a result of using a 1X rate and 7 day PHI) and inconsistent data (for tangerines and grapefruit, the washed peel exhibited higher residues than the unwashed peel). However, the following weight ratios of peel to total fruit presented in PP#5G3287/5H5474 will be

used to calculate both the acute and chronic peel values used in the DRES analysis:

orange peel : whole orange (Hamlin) (1 : 5)
grapefruit peel : whole grapefruit (1 : 3.5)
lemon peel : whole lemon (1 : 2.5)

The following citrus fractionation percentages were listed in PP#1F2507/1H5301 as the standards of the Florida Citrus Industry:

oranges

Temple oranges
- 51.1% juice
- 48.9% peel, rag, and seeds
  - 15.3% press liquor
    - 2.2% molasses
  - 33.6% pressed peel + pulp (approximately 1:1)
    - 8.3% dry citrus peel + pulp (10% moisture)
- 0.11% oil

Hamlin oranges
- 52.2% juice
- 47.8% peel, rag, and seeds
  - 14.2% press liquor
    - 1.7% molasses
  - 33.6% pressed peel + pulp (approximately 1:1)
    - 8.3% dry citrus peel + pulp (10% moisture)
- 0.09% oil

grapefruit
- 48.1% juice
- 51.9% peel, rag and seeds
  - 15% press liquor
    - 1.8% molasses
  - 36.9% pressed peel + pulp (approximately 1:1)
    - 10.4% dry citrus peel + pulp (10% moisture)
- 0.09% oil

Based on the fractionation percentages listed above and the residue levels from the processing study listed in Table 8, the following assumptions can be made:

Oranges

The dried pulp and peel accounts for 8.3% of the total orange weight and contained 44.1 ppb of avermectin residues in Hamlin oranges. This is equivalent to 3.66 ppb on a whole orange percentage (44.1 X 0.083). Citrus oil accounts for 0.09% of the total orange weight and contained 54.1 ppb of avermectin residues. This is equivalent to 0.05 ppb on a whole orange percentage (54.1 X 0.0009). Together, the two account for 3.71 ppb of the <5 ppb total avermectin residues on the whole washed orange and leaves a maximum of 1.32 ppb remaining for the juice (52.2% of the whole

orange) and press liquor (14.2%). Assuming a worst-case scenario where avermectin residues are not lost or degraded during the processing and all the residue is contained in the juice (none in the press liquor), then the concentration in juice is a maximum of 1.32 ppb on a whole fruit basis or 2.53 ppb (1.32 ÷ 0.522). Therefore, the concentration factor in juice from the whole, unwashed fruit is **.25** (2.53 ÷ 9.9).

For undried orange peel (the DRES commodity, not the animal feed item), if we assume a 1 : 5 ratio of peel to whole fruit (see above), and all the residue from the washed fruit (<5 ppb) is in the peel, the maximum residue in the peel would be 25 ppb (<5 ÷ (1 ÷ 5) or a concentration factor of **2.5** from the whole washed fruit (25 ÷ 9.9).

For undried orange pulp, we will assume the same 1 : 5 ratio of pulp to whole fruit that we did with peel (since the peel to pulp ratio is approximately 1:1 in citrus). A citrus metabolism study that was submitted in conjunction with PP#5G3287/5H5474 (memo of L. Cheng dated 12/19/85), indicated that residues in orange pulp will be less < 10% of those in whole fruit, even up to 12 weeks after application. In this case, 10% of the unwashed orange residue value of 9.9 ppb is 0.99 ppb. Therefore, the maximum residue in the pulp would be 4.95 ppb (0.99 ÷ (1 ÷ 5) or a concentration factor of **0.5** from the whole unwashed fruit (4.95 ÷ 9.9).

Grapefruit

The dried pulp and peel accounts for 10.4% of the total grapefruit weight and contained 10.9 ppb of avermectin residues. This is equivalent to 1.19 ppb on a whole grapefruit percentage (10.9 X 0.109). Citrus oil accounts for 0.09% of the total grapefruit weight and contained 87.3 ppb of avermectin residues. This is equivalent to 0.08 ppb on a whole grapefruit percentage (87.3 X 0.0009). Together, the two account for 1.27 ppb of the <5 ppb total avermectin residues on the whole washed grapefruit and leaves a maximum of 3.73 ppb remaining for the juice (48.1% of the whole grapefruit) and press liquor (15%). Assuming a worst-case scenario where avermectin residues are not lost or degraded during the processing and all the residue is contained in the juice (none in the press liquor), then the concentration in juice is a maximum of 3.73 ppb on a whole fruit basis or 7.75 ppb (3.73 ÷ 0.481). Therefore, the concentration factor in juice from the whole, unwashed fruit is **0.85** (7.75 ÷ 9.0).

For undried orange pulp, we will assume the same 1 : 3.5 ratio of pulp to whole fruit (since the peel to pulp ratio is approximately 1:1 in citrus). A citrus metabolism study that was submitted in conjunction with PP#5G3287/5H5474 (memo of L. Cheng dated 12/19/85), indicated that residues in orange pulp will be less < 10% of those in whole fruit, even up to 12 weeks after application; we will assume the same relative levels in grapefruit

due to relative weight percentages of orange and grapefruit commodities, and the non-systemic nature of avermectin. In this case, 10% of the unwashed orange residue value of 9.0 ppb is 0.9 ppb. Therefore, the maximum residue in the pulp would be 4.5 ppb (0.9 ÷ (1 ÷ 5) or a concentration factor of **0.5** from the whole unwashed fruit (4.5 ÷ 9.0).

Other citrus

Based on the lack of fractionation and processing data, their low dietary consumption when compared to oranges and grapefruit, and their relative size (closer to orange than grapefruit), CBTS recommends that the concentration factors from oranges be used to calculate concentration factors for lemons, limes, kumquats, and tangerines.

Conclusions

Based on the concentration factors discussed above, **the following residue values should be used for estimating the chronic anticipated residues for the following processed citrus commodities.**

DRES entries CAR = chronic anticipated residue of the RAC

grapefruit	
juice	**0.85 X CAR = 0.00085 ppm**
pulp	**0.5 X CAR = 0.0005 ppm**
lemons	
juice	**0.25 X CAR = 0.00025 ppm**
peel	**2.5 X CAR = 0.0025 ppm**
pulp	**0.5 X CAR = 0.0005 ppm**
limes	
juice	**0.25 X CAR = 0.00025 ppm**
peel	**2.5 X CAR = 0.0025 ppm**
pulp	**0.5 X CAR = 0.0005 ppm**
kumquats	**CAR = 0.004 ppm (taken from orange)**
orange	
juice	**0.25 X CAR = 0.001 ppm**
peel	**2.5 X CAR = 0.01 ppm**
pulp	**0.5 X CAR = 0.002 ppm**
tangerine	**CAR = 0.001 ppm (taken from tangelo)**
tangerine juice	**0.25 X CAR = 0.00025 ppm**

Animal Feed Items

dry pulp (pulp + peel) 4.5 (from Table 9) X CAR (orange) = 0.018

Cotton

The current label rate is 0.025 lb.ai./A./application with a 20 day PHI.

Acute

The established tolerance for residues of avermectin on cottonseed is 0.005 ppm. Cottonseed meal (animal feed item), meal (the DRES commodity - taken from the residue value for the seed), and oil (the DRES commodity) are the processed commodities. Based on the field trial residue data, metabolism study, and processing factors listed below (under Chronic), **CBTS recommends that the following values be used in the analysis for determining the acute anticipated residues in cotton products.**

cottonseed (RAC)	**RAC = 0.005 ppm**
meal (DRES entry)	**RAC = 0.005 ppm**
oil (DRES entry)	**RAC ÷ 8 = 0.00063 ppm**
meal (animal feed item)	**RAC = 0.005 ppm**
hulls (animal feed item)	**RAC = 0.005 ppm**

Chronic

Residue data for cottonseed was taken from that submitted to support PP#6G3320 and PP#7F3500.

Field Trial Data

Sixteen residue trials were conducted at various rates (4 trials were conducted at 4X) and PHIs (samples from one of the 4X trials was harvested at a 2 day PHI). In all cases, no detectable residues were found in cottonseed (< 5 ppb), meal (< 5 ppb), or hulls (< 5 ppb).

^{14}C-Labeled Metabolism Study

A ^{14}C-labeled cotton metabolism study was submitted in conjunction with PP#7F3500. An 8X rate was applied and cottonseed was harvested 21 days later (same as labeled PHI). The following TRR levels were found: seed (50 ppb), meal (44 ppb), and hull (46 ppb). Approximately 30% of the radioactivity from the seed extracted into the hexane layer, but was not retained on the silica column, as avermectin and its delta 8,9 isomer would have been. The major peaks of radioactivity from the hexane fraction co-chromatographed with linoleic and palmitic acid, which shows incorporation taking place. The limit of quantitation was not stated but, conservatively, was estimated to be 1 ppb (Realistically, it is probably closer to 0.2 ppb.).

Conclusions

At a 21 day PHI, cottonseed oil would not contain detectable quantities of the avermectin residues listed in the tolerance expression. The oil that was analyzed was very crude (no purification was performed), so the consumed, purified cottonseed oil (DRES commodity) would have a further safety factor.

Unless they are bound, it is unlikely that detectable quantities of the avermectin residues listed in the tolerance expression would be found in cottonseed.

The presence of radioactivity in the form of linoleic and palmitic acid, represents incorporation taking place and affirms the 2 conclusions above.

Based on the 8X rate and conservative 1 ppb detection limit from the hot study, coupled with the non-detectable residues from the cold field trial using a 4X rate and 2 day PHI, **CBTS recommends that the following values be used in the analysis for determining the chronic anticipated residues in cotton products based on the label rate and 20 day PHI.**

CAR = chronic anticipated residue of the RAC

cottonseed (RAC)	**CAR = ½ X 1 ppb LOQ (hot study) =**	**0.0005 ppm**
meal (DRES entry)	**CAR =**	**0.0005 ppm**
oil (DRES entry)	**⅛ X 1 ppb LOQ (hot study) =**	**0.0002 ppm**
meal (animal feed item)	**CAR =**	**0.0005 ppm**
hulls (animal feed item)	**CAR =**	**0.0005 ppm**

Lettuce

The current label rate is 0.02 lb.ai./A./application with a 7 day PHI.

Acute

CBTS has recommended that a tolerance of 0.05 ppm be established for the residues of avermectin on head lettuce (see memo of G.J. Herndon dated 11/16/94). No additional processed commodities are associated with this RAC. **CBTS recommends that the tolerance value of 0.05 ppm be used as the acute anticipated residue for lettuce.**

Chronic

The residue data shown in Table 10 below are based on a 1X rate and 7 day PHI (except trial 001-87-1001R where samples were harvested at a 5 day PHI).

Table 10

Residue Summary of Avermectin in/on Head Lettuce

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-87-1001R	29.6	NQ (5)	34.6
	28.5	NQ (5)	33.5
001-87-5027R	5.3	ND (1)	6.3
	6.6	ND (1)	7.6
001-88-1066R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-89-1002R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-89-1043R	25.2	NQ (5)	30.2
	20.9	NQ (5)	25.9
001-89-1048R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-89-0046R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-89-0047R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-89-6055R	5.6	ND (1)	6.6
	21.5	NQ (5)	26.5
001-89-6052R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-90-1008R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25

From the data above, a mean of 8.58 ppb was determined (22 entries for a total of 188.7 ppb). **CBTS recommends that a value of 0.009 ppm be used as the chronic anticipated residue for head lettuce.**

Pears

The proposed label rate is 0.025 lb.ai./A./application with a 28 day PHI.

Acute

Provided the proposed enforcement method passes Beltsville lab validation, CBTS will recommend that a tolerance of 0.02 ppm be established for the residues of avermectin on pears (see memo of G.J. Herndon dated 10/21/94). No additional processed commodities are associated with this RAC. **CBTS recommends that the proposed tolerance value of 0.02 ppm be used as the acute anticipated residue for pears. DRES assumes a 4.4X concentration factor for dried pears, so 0.088 ppm (0.02 X 4.4) should be used as**

the acute anticipated residue for dried pears.

Chronic

The following residue data were reviewed in support of PP#9F3787 (see memo of G.J. Herndon dated 10/27/94).

The residue data shown in Table 11 below are based on a 1X rate and 21 day PHI (proposed label PHI is 28 days).

Table 11

Residue Summary of Avermectin in/on Pears

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-92-6016R	3.85	ND (0.5)	4.4
	3.36	ND (0.5)	3.9
001-92-6017R	4.84	ND (0.5)	5.3
	5.93	ND (0.5)	6.4
001-92-6018R	5.59	ND (0.5)	6.1
	8.91	NQ (2)	10.9
001-92-6019R	10.6	NQ (2)	12.6
	7.84	NQ (2)	9.8

Other Field Trial Data

Residue data from 9 sites and 1X and 2X rates were provided, but are of limited value due to their maximum 14 day PHI. However, taking the residue values from the trial that exhibited the highest residue value at a 14 day PHI (trial 001-87-5013R), and plugging 5 residue data points (from 0, 1, 3, 7, and 14 day PHIs) into a linear regression curve, a theoretical value of 0.007 ppm is calculated for an extrapolated 28 day PHI. This is in close agreement to the 21 day PHI data presented in Table 11.

From the residue data provided in Table 11 above, a mean of 7.4 ppb was determined (8 entries for a total of 59.4 ppb). **CBTS recommends that a value of 0.008 ppm be used as the chronic anticipated residue for pears. DRES assumes a 4.4X concentration factor for dried pears, so 0.035 ppm (0.008 X 4.4) should be used as the chronic anticipated residue for dried pears.**

Strawberries

The labeled rate is 0.02 lb.ai./A./application with a 3 day PHI.

Acute

CBTS has recommended that a tolerance of 0.02 ppm be established for the residues of avermectin on strawberries (see memo of J. Stokes dated 2/3/94). No additional processed commodities are associated with this RAC. **CBTS recommends that the proposed tolerance value of 0.02 ppm be used as the acute anticipated residue for strawberries.**

Chronic

The residue data shown in Table 12 below were submitted in conjunction with PP#0F3880 and are based on the label rate and PHI.

Table 12

Residue Summary of Avermectin in/on Strawberries

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-88-1026R	NQ (2)	ND (0.5)	2.5
	5.7	ND (0.5)	6.2
	NQ (2)	ND (0.5)	2.5
	8.8	ND (0.5)	9.3
001-88-1027R	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5
	5.8	ND (0.5)	6.3
	6.7	ND (0.5)	7.2
	5.3	ND (0.5)	5.8
	5.6	ND (0.5)	6.1
	7.6	ND (0.5)	8.1
	8.4	ND (0.5)	8.9
001-88-6020R	5.6	ND (0.5)	6.1
	5.6	ND (0.5)	6.1
	7.4	ND (0.5)	7.9
	6.9	ND (0.5)	7.4
	ND (0.5)	ND (0.125)	0.63
	7.8	ND (0.5)	8.3
	8.5	ND (0.5)	9.0
	7.7	ND (0.5)	8.2

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-88-6021R	5.0	ND (0.5)	5.5
	11.9	ND (0.5)	12.4
	9.0	ND (0.5)	9.5
	5.9	ND (0.5)	6.4
001-89-0004R	6.4	ND (0.5)	6.9
	5.6	ND (0.5)	6.1
	7.1	ND (0.5)	7.6
	6.2	ND (0.5)	6.7
001-89-0005R	5.9	ND (0.5)	6.4
	5.1	ND (0.5)	5.6
	7.5	ND (0.5)	8.0
	5.9	ND (0.5)	6.4
001-89-0024R	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
001-89-1007R	NQ (2)	ND (0.5)	2.5
	6.2	ND (0.5)	6.7
	6.5	ND (0.5)	7.0
	7.7	ND (0.5)	8.2
001-89-1018R	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
001-89-1019R	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
001-89-1020	10.7	ND (0.5)	11.2
	8.4	ND (0.5)	8.9
	8.0	ND (0.5)	8.5
	8.1	ND (0.5)	8.6
001-89-1021R	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
001-89-3004R	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-89-3005R	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
	ND (0.5)	ND (0.125)	0.63
001-89-6003R	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5
	NQ (2)	ND (0.5)	2.5
	5.2	ND (0.5)	5.7

From the data above, a mean of 4.3 ppb was determined (68 entries for a total of 292.13 ppb). **CBTS recommends that a value of 0.004 ppm be used as the chronic anticipated residue for strawberries.**

Tomatoes

The label rate is 0.02 lb.ai/A./application with a 7 day PHI.

Acute

The following tolerances have been established for residues of avermectin on tomatoes:

fresh tomatoes - 0.01 ppm
tomato pomace - 0.07 ppm

Based on the concentration factors discussed below (see Processing Data under Chronic), **the following residue values should be used for estimating the acute anticipated residues for the following processed tomato commodities.**

DRES entries
tomato
whole **tolerance on RAC = 0.01 ppm**
catsup **1.1 X RAC = 0.011 ppm**
juice **0.21 X RAC = 0.0021 ppm**
paste **1.2 X RAC = 0.012 ppm**
puree **0.40 X RAC = 0.004 ppm**
Animal feeds
dried tomato pomace tolerance = 0.07 ppm

Chronic

The residue data shown in Table 13 below were submitted in conjunction with PP#9F3703/9H5570 and are based on 1X rate and 7 day PHI, except where noted otherwise.

Table 12

Residue Summary of Avermectin in/on Tomatoes

	Avermectin Residues (ppb)		
Study ID	B_1a	B_1b	Total
001-86-030R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-031R (5 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-032R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6
001-86-033R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-148R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-149R (3 day PHI)	ND (1)	ND (0.25)	1.25
001-86-301R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-86-559R	5.4	ND (1)	6.4
	NQ (5)	ND (1)	6
	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6
001-86-672R (5 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-0010R (3 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6

Study ID	Avermectin Residues (ppb)		
	B_1a	B_1b	Total
001-87-0011R (3 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-1000R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-1011R	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6
	21.2	NQ (5)	26.2
001-87-3004R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-3012R (3 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-3036R (3 day PHI)	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-5024R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-5025R	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6
	6.7	ND (1)	7.7
001-87-5026R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
001-87-6001R	ND (1)	ND (0.25)	1.25
	ND (1)	ND (0.25)	1.25
	NQ (5)	ND (1)	6

From the data above, a mean of 2.2 ppb was determined (66 entries for a total of 146.3 ppb). **CBTS recommends that a value of 0.002 ppm be used as the chronic anticipated residue for tomatoes.**

Processing

A processing study was submitted in conjunction with PP#9F3703/9H5570, that was conducted using a 2X rate. The results are shown in Table 13 below. For the residue values that are listed as < 5 ppm (NQ) or < 2 ppm (ND), an assumption has been made that the actual residue values are ½ of these amounts (2.5 and 1 ppm, respectively), and the concentration of B_1b can only be a maximum of 25% of the concentration of B_1a.

Table 13

Results from a Tomato Processing Study Using a 2X Rate

Matrix	Avermectin Residues (ppb)				
	B_1a	B_1b	Total	Average	Concentration Factor (from fresh whole tomato)
fresh whole tomato	< 5 (2.5)	< 2 (0.63)	3.13	3.13	N/A
washed whole tomato	< 2 (1)	< 2 (0.25)	1.25	1.25	0.40
canned puree	< 2 (1)	< 2 (0.25)	1.25	1.25	0.40
	< 2 (1)	< 2 (0.25)	1.25		
wet pomace	16.2	< 2 (1)	17.2	17.3	5.53
	16.4	< 2 (1)	17.4		
dry pomace	93.5	9.5	103	115.8	37.0
	116	12.5	128.5		

The theoretical concentration factors for a generic tomato fractionation study are presented in Table 14. These data were provided to the Agency by Merck in PP#9F3703/9H5570, and were performed by Reed D. Smith Associates, Inc.

Table 14

Theoretical Concentration Factors from a Generic Tomato Fractionation Study

Matrix	Theoretical Concentration Factor
fresh juice	1.15
wet pomace	7.78
dry pomace	77.8
peel	4.80
canned stewed	1.26
cannery waste	7.78
canned puree	2.3
paste	6.9
ketchup	6.28
canned juice	1.19
canned sauce	2.18

Based on various flow charts on tomato fractionation and the values supplied in Table 14, wet tomato pomace and cannery waste appear to be the same product physically (skin + seeds), with the term "wet tomato pomace" being used to describe the byproduct of fresh tomato juice production, and "cannery waste" describing the byproduct tomato puree production. Tomato puree can be converted into either canned puree or paste, and paste can be converted into

canned tomato juice, canned sauce, canned paste, or ketchup.

The concentration factor values in Table 13 show that the value for wet tomato pomace (5.53) is close to that of theoretical (7.78 from Table 14). This implies that the avermectin residues in/on tomatoes are mainly surface residues (71% of theoretical). Therefore, the low concentration factor (0.40 in Table 13) for the remaining product, canned puree, vs. theoretical (2.3 from Table 14) makes sense. Since tomato paste, ketchup, canned juice, and canned sauce are all derived from tomato puree, the following actual (avermectin residue) concentration factors can be derived based on the canned puree factor of 0.40 from fresh whole tomatoes.

canned tomato juice	(0.40 X (1.19 ÷ 2.3)) = 0.21
ketchup	(0.40 X (6.28 ÷ 2.3)) = 1.1
paste	(0.40 X (6.90 ÷ 2.3)) = 1.2

Based on the concentration factors discussed above, **the following residue values should be used for estimating the chronic anticipated residues for the following processed tomato commodities.**

DRES entries CAR = chronic anticipated residue of the RAC = 0.002 ppm

tomato

whole	**CAR = 0.002 ppm**
catsup	**1.1 X CAR = 0.0022 ppm**
juice	**0.21 X CAR = 0.00042 ppm**
paste	**1.2 X CAR = 0.0024 ppm**
puree	**0.40 X CAR = 0.0008 ppm**

Animal feeds

dried tomato pomace 5.53 (from Table 13) X CAR = 0.011 ppm

Walnuts

The proposed label rate is 0.025 lb.ai./A./application with a 21 day PHI.

Acute

The pending tolerance (PP#1F3973) for residues of avermectin on walnuts is 0.005 ppm. No additional processed commodities are associated with this RAC. **CBTS recommends that the proposed tolerance of 0.005 ppm be used as the acute anticipated residue for walnuts.**

Chronic

Data on walnut nutmeats were provided in conjunction with PP#1F3973 (see memo of G.J. Herndon dated 11/26/91). At 1X (0.025 lb.ai./A.) and 2X rates and a 14 day PHI (21 day PHI is proposed on the label), all samples (40 total samples analyzed) were ND for

both B_1a to B_1b. Therefore, for chronic risk assessment purposes, we will use a B_1a concentration of 1 ppb and a B_1b concentration of 0.25 ppb, for a total of 1.25 ppb. **CBTS recommends that a value of 0.00125 ppm be used as the chronic anticipated residue for walnuts.**

Milk

Acute

The established tolerance for residues of avermectin in milk is 0.005 ppm.

Based on a production figure of 50 pounds of milk per day, a realistic cow diet was established based on our in-house Spartan Dairy Ration Evaluator program. The residue levels used for the feed items in Table 15 are the same as those developed for acutes earlier in the memo.

Table 15

Maximum Avermectin Residues in Dairy Cattle from Various Crops

					Maximum Avermectin Residues (ppb)	
Ingredients	pounds of dry matter	pounds (as fed)	% in diet (based on dry matter)	% in diet (as fed)	In Feed Items	In the Diet (normalized to 100% total of all feed items)
alfalfa hay	13	14.8	32.5%	33.26%	N/A	N/A
almond hulls	6	6.7	15%	15.06%	100	15.06
cotton hulls	6	6.6	15%	14.83%	5	0.742
cottonseed meal	3	3.2	7.5%	7.19%	5	0.360
tomato pomace (dried)	4	4.3	10%	10%	70	7.00
citrus pulp (dried)	8	8.9	20%	20%	100	20.0
TOTAL	40	44.5	100%	100%	N/A	43.2

Using the feed factor (dose) for dairy cattle at 43 ppb, the potential maximum residues of avermectin B^1 in milk can be estimated. The 28 day feeding study submitted with PP#7G3468 (see memo of L. Cheng dated 2/11/87) was performed on dairy cattle at levels of 10, 30, and 100 ppb of avermectin residues in the diet. The milk levels are summarized in Table 16.

Table 16

Avermectin Levels in Cows Milk from a 28 Day Feeding Study

	Avermectin Residues (ng/mL) in Various Milk Samples During the 28 Day Dosing Period at 3 Feeding Levels		
Day	10 ppb	30 ppb	100 ppb
1	ND	ND	ND
2	ND	ND	ND - 1 ppb (ave. = 0.5 ppb)
3	ND	ND	ND - 1 ppb (ave. = 0.5 ppb)
5	ND	ND - 1 ppb (ave. = 0.5 ppb)	ND - 1 ppb (ave. = 0.5 ppb)
7	ND	ND	1 - 2 ppb (ave. = 1.3 ppb)
14	ND	ND	1 - 4 ppb (ave. = 2.3 ppb)
28	ND	ND	1 ppb (ave. = 1 ppb)
Average	0.25 ppb	0.36 ppb	0.91 ppb

ND - not detected down to the lower limit that adequate method recoveries were achieved (0.5 ppb). For the purposes of the risk assessment, an ND value of ½ X 0.5 ppb, or 0.25 ppb will be used.

Since milk from various cows is mixed and composited, an average residue value during the 28 day dosing period from the 100 ppb feeding level was chosen to best correspond to the cow consuming a theoretical 43 ppb of residue in its diet. Therefore, from feeding 43 ppb of residues, residues in milk would be estimated to be 1 ppb. **CBTS recommends that a value of 0.001 ppm be used as the acute anticipated residue for milk.** Avermectin is intermediate in polarity (very soluble in chloroform, not as soluble in hexane or water). The normal concentration factors that would be applied to the DRES entries for non-fat milk solids and milk fat are 8X. Based on its solubility, for risk assessment purposes, CBTS will assume that ½ of the residue will go into each fraction (concentration factors of 4X for each). **Therefore, the following residue values should be used for estimating the acute anticipated residues for the following DRES milk entries.**

CAMR - calculated acute milk residue = 0.001 ppm

milk fat 4 X CAMR = 0.004 ppm
non-fat milk solids 4 X CAMR = 0.004 ppm
milk sugar CAMR = 0.001 ppm

Chronic

Based on a production figure of 50 pounds of milk per day, a realistic cow diet was established based on our in-house Spartan Dairy Ration Evaluator program. The residue levels used for the feed items in Table 17 are the same as those developed for chronics earlier in the memo.

Table 17

Maximum Avermectin Residues in Dairy Cattle from Various Crops

Ingredients	pounds of dry matter	pounds (as fed)	% in diet (based on dry matter)	% in diet (as fed)	Maximum Avermectin Residues (ppb)	
					In Feed Items	In the Diet (normalized to 100% total of all feed items)
alfalfa hay	13	14.8	32.5%	33.26%	N/A	N/A
almond hulls	6	6.7	15%	15.06%	39.0	5.873
cotton hulls	6	6.6	15%	14.83%	0.5	0.0742
cottonseed meal	3	3.2	7.5%	7.19%	0.5	0.0360
tomato pomace (dried)	4	4.3	10%	10%	11	1.10
citrus pulp (dried)	8	8.9	20%	20%	18	3.60
TOTAL	40	44.5	100%	100%		10.7

Using the feed factor (dose) for dairy cattle at 11 ppb, the potential maximum residues of avermectin B^1 in milk can be estimated. Data from the same 28 day feeding study that was used for the acute dietary risk assessment (see Table 16 above) was used. An average residue value from the 10 ppb feeding level was chosen to best correspond to the cow consuming a theoretical 11 ppb of residue in its diet. Therefore, from feeding 11 ppb of residues, residues in milk would be estimated to be 0.25 ppb. **CBTS recommends that a value of 0.00025 ppm be used as the chronic anticipated residue for milk.** Avermectin is intermediate in polarity (very soluble in chloroform, not as soluble in hexane or water). The normal concentration factors that would be applied to the DRES entries for non-fat milk solids and milk fat are 8X. Based on its solubility, for risk assessment purposes, CBTS will assume that ½ of the residue will go into each fraction (concentration factors of 4X for each). **Therefore, the following residue values should be used for estimating the chronic anticipated residues for the following DRES milk entries.**

CCMR - calculated acute milk residue = 0.00025 ppm

milk fat 4 X CCMR = 0.001 ppm
non-fat milk solids 4 X CCMR = 0.001 ppm
milk sugar CCMR = 0.00025 ppm

Meat, Meat Byproducts, and Fat

Acute

Based on a intake figure of 1.8 pounds of crude protein and 18 pounds of dry matter, a realistic diet for an 800 pound steer was established based on our in-house Spartan Dairy Ration Evaluator program. The residue levels used for the feed items in Table 18 are the same as those developed for acutes earlier in the memo.

Table 18

Maximum Avermectin Residues in Beef Cattle from Various Crops

Ingredients	pounds of dry matter	pounds (as fed)	%.in diet (based on dry matter)	% in diet (as fed)	Maximum Avermectin Residues (ppb)	
					In Feed Items	In the Diet (normalized to 100% total of all feed items)
almond hulls	4.5	5.0	25%	25.33%	100	25.33
cottonseed	0.4	0.44	2.2%	2.21%	5	0.1105
fescue hay	4.0	4.4	22.8%	22.87%	N/A	N/A
tomato pomace (dried)	4.5	4.9	25%	24.82%	70	17.37
citrus pulp (dried)	4.5	5.0	25%	25.33%	100	25.33
TOTAL	18	19.74	100%	100.5%	N/A	68.1

Using the feed factor (dose) for dairy cattle at 68 ppb, the potential maximum residues of avermectin in meat, fat, and meat byproducts can be estimated. The 28 day feeding study submitted with PP#7G3468 (see memo of L. Cheng dated 2/11/87) was performed on dairy cattle at levels of 10, 30, and 100 ppb of avermectin residues in the diet. The levels are summarized in Table X.

Table 19

Avermectin Levels in Dairy Cattle Tissues from a 28 Day Feeding Study

Dose (ppb)	Avermectin Levels in Various Tissues and Organs (ppb)			
	Liver	Muscle	Fat	Kidney
10	3 - 4	1 - 2	2	1 - 2
30	5 - 8	2	4 - 6	2
100	18 - 20	2	10 - 14	4 - 5

The residue levels from the 100 ppb feeding were chosen to best represent the residue levels from a theoretical 68 ppb diet. Based on this, **the following residue values should be used for estimating the acute anticipated residues for the following DRES beef entries.**

beef

fat	**0.014 ppm**	
lean	**0.002 ppm**	
kidney	**0.005 ppm**	
liver	**0.020 ppm**	
dried	**0.002 ppm**	**(same as lean)**
byproducts	**0.020 ppm**	**(taken from liver)**

Chronic

Based on a intake figure of 1.8 pounds of crude protein and 18 pounds of dry matter, a realistic diet for an 800 pound steer was established based on our in-house Spartan Dairy Ration Evaluator program. The residue levels used for the feed items in Table 20 are the same as those developed for chronics earlier in the memo.

Table 20

Maximum Avermectin Residues in Beef Cattle from Various Crops

Ingredients	pounds of dry matter	pounds (as fed)	% in diet (based on dry matter)	% in diet (as fed)	Maximum Avermectin Residues (ppb)	
					In Feed Items	In the Diet (normalized to 100% total of all feed items)
almond hulls	4.5	5.0	25%	25.33%	39	9.879
cottonseed	0.4	0.44	2.2%	2.21%	0.5	0.01105
fescue hay	4.0	4.4	22.8%	22.87%	N/A	N/A
tomato pomace (dried)	4.5	4.9	25%	24.82%	11	2.730
citrus pulp (dried)	4.5	5.0	25%	25.33%	18	4.559
TOTAL	18	19.74	100%	100.5%	N/A	17.2

Using the feed factor (dose) for dairy cattle at 17 ppb, the potential maximum residues of avermectin B^1 in meat, fat, and meat byproducts can be estimated. Data from the same 28 day feeding study that was used for the acute dietary risk assessment (see Table 19 above) was used. The residue levels from the 30 ppb feeding were chosen to best represent the residue levels from a theoretical 17 ppb diet. Based on this, **the following residue values should be used for estimating the chronic anticipated residues for the following DRES beef entries.**

beef

fat	**0.006 ppm**	
lean	**0.002 ppm**	
kidney	**0.002 ppm**	
liver	**0.008 ppm**	
dried	**0.002 ppm**	**(DRES uses beef lean value)**
byproducts	**0.008 ppm**	**(taken from liver)**

cc: circu., RF, SF, PP#9F3787, E. Haeberer (section head), G.J. Herndon.

RDI: Section Head: E. Haeberer: 12/16/94,
Acting Branch Senior Scientist: M. Flood: 12/16/94,
Acting Branch Chief: R. Loranger: 12/20/94.

H7509C: CBTS: G.J. Herndon: 305-6362: CM#2, Rm. 804C: 12/6/94.